Subject: Revision of Multiple Burst Lightning Environment   Date: AUG 25 1993

From: Manager, Aircraft Engineering Division, AIR-100   Reply to
                                                                  Attn of:

To: Manager, Transport Airplane Directorate, ANM-100
      Manager, small Airplane Directorate, ACE-l00
      Manager, Rotorcraft Directorate, ASW-100
      Manager, Engine and Propeller Directorate, ANE-100
      Manager, Brussels Aircraft Certification Staff, AEU-100

Appendix III in Advisory Circular (AC) 20-136, "Protection of Aircraft Electrical/Electronic Systems Against the Indirect Effects of Lightning," defines the multiple burst lightning environment to be used for test and analysis purposes in qualifying systems and equipment for lightning protection. This multiple burst environment consists of 24 sets of 20 pulses each, distributed over a period of up to two seconds. The minimum time between the individual pulses within a burst is 10 μ s, the maximum is 50 μ s. The 24 bursts are distributed over a period of up to two seconds with the minimum time between subsequent bursts being 10 ms, and the maximum being 200 ms.

As part of an ongoing review of natural lightning phenomenology and data from in-flight measurements of electrical parameters, SAE Committee AE4L and EUROCAE WG-31 recommended that the multiple burst definition be modified from the current 24 burst of 20 pulses to 3 bursts of 20 pulses. The minimum time between individual pulses within a burst was changed from 10 μ s to 50 μ s, and the maximum from 50 μ s to 1,000 μ s. In addition, the minimum time period between subsequent bursts was changed from 10 ms to 30 ms, and the maximum time from 200 ms to 300 ms. Attachment 1 contains the committees' recommendation.

The Aircraft Certification Lightning Steering Committee has reviewed the recommendation presented by AE4L arid WG-31, and has advised that these changes be incorporated into AC 20-136. Lightning protection special conditions that are currently being issued for new certification projects will use the new definition for the multiple burst environment. Certification projects currently in progress should accept this criteria if so requested by the applicant.

If there are any questions or comments on this policy, the engineer on my staff who is most familiar with these issues is Mr. George Soteropoulos, AIR-120, telephone (202) 267-9796.

Signed by John K. McGrath

Attachment

Committee Correspondence

Name of Committee:	SAE AE4L (lightning) EUROCAE WG-31	Date: 6 July 1992
Subject:	Multiple Burst Definition	Reply to:
To:	Users of SAE-AE4L and EUROCAE WG-31 Lightning Criteria	

At our meetings of 5-6 May and 9-11 June 1992 respectively, EUROCAE WG-31 and SAE Committee AE4L voted to recommend to users of EUROCAE WG-31 and SAE-AE4L lightning criteria that the definition of the Multiple Burst environment be changed from 24 bursts to 3 bursts and otherwise be re-defined as in the attached description and figure.

This action was taken following a continuing review of natural lightning data, including especially the data from airborne measurements of intra-cloud lightning characteristics taken in the US and Europe. This review has been conducted jointly by our committees, which are the focal points in the US and Europe for technical aspects of aircraft lightning standards. The multiple burst topic was reviewed in depth, for example, at a meeting with lightning phenomenologists in conjunction with the 1991 International Conference on Lightning and Static Electricity in April, 1991.

The Multiple Burst environment is published in the following publications:

- SAE Committee Report, SAE AE4L-87-3, Rev. B, "Recommended Draft Advisory Circular Protection of Aircraft Electrical/Electronic Systems Against the Indirect Effects of Lightning" Appendix III

- FAA Advisory Circular 20-136, "Protection of Aircraft Electrical/Electronic Systems Against the Indirect Effects of Lightning" Appendix III

- DOT/FAA/CT-89/22, "Aircraft Lightning Protection Handbook"

- US MIL-STD-1795A, "Lightning Protection of Aerospace Vehicles and Hardware"

- NASA STS 07636, Rev. A, "Space Shuttle Lightning Criteria"

Our committees recommend that, henceforth, the Multiple Burst environment in the above documents be replaced with the revised definition (description and figure), and that the revised definition be the basis for future protection design and certification/qualification tests or analyses.
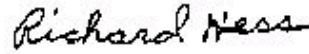
It is further recommended that the revised Multiple Burst definition be incorporated in future revisions of the above documents, and other documents employing SAE AE4L or EUROCAE WG-31 criteria, at such times as these documents are next revised or updated.

Our committee wishes to add that this recommended change should not affect the lightning-related safety or certification status of systems certified or qualified in accordance with the original Multiple Burst definition. Questions regarding this recommendation may be addressed to any of the undersigned.
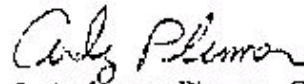
Yours truly,

Dieter Jaeger, Co-chairman
EUROCAE WG-31
MBB/Munchen/Germany
Phone: (089)607-23949

Richard F. Hess, Co-chairman
SAE AE4L
Honeywell/Phoenix, AZ/USA
Phone: (602)436-1285
FAX: (602)436-2252

Robert J. Ringrow, Co-chairman
EUROCAE WG-31
Shorts Brothers/Belfast/UK

J. Anderson Plumer, Co-chairman
SAE AE4L
Lightning Technologies, Inc.
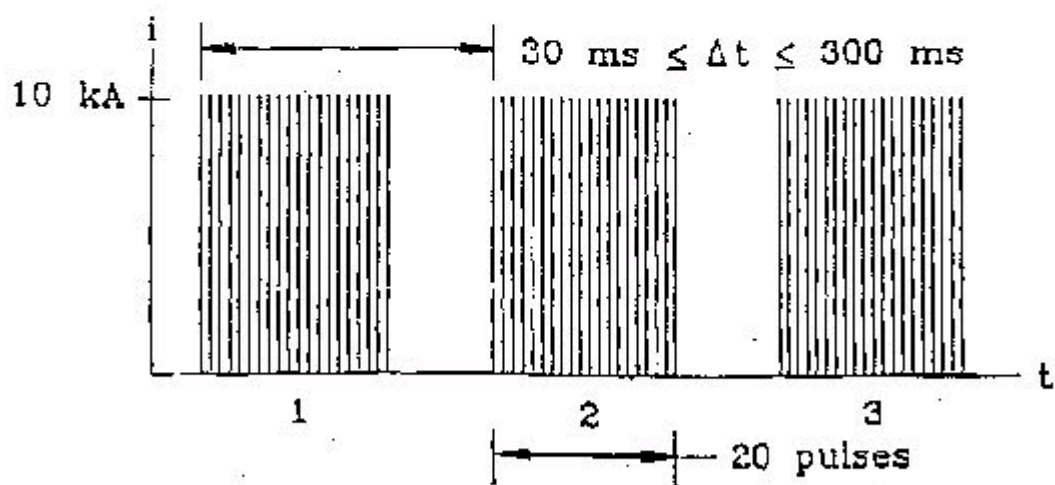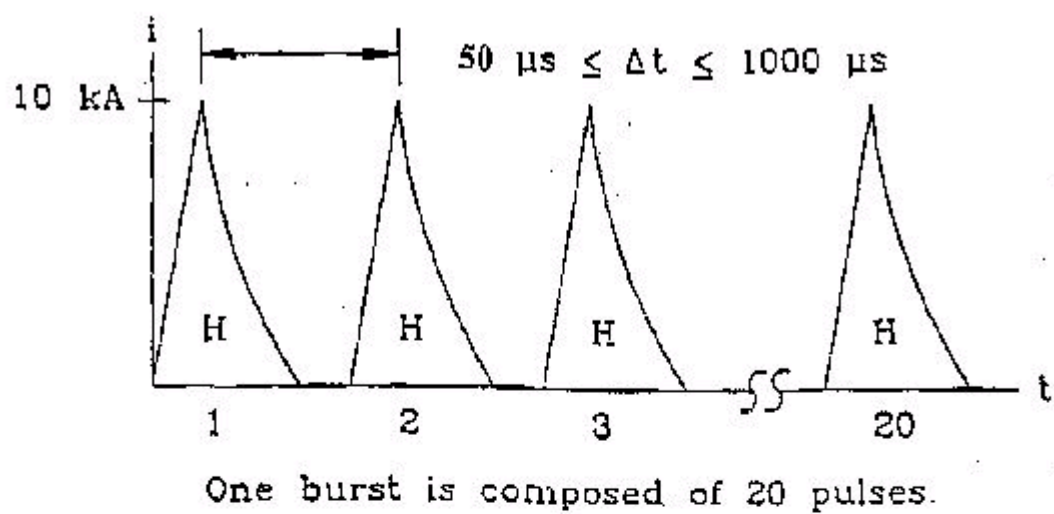Pittsfield, MA/USA
Phone: (413)499-2135
FAX: (413)499-2503

Multiple Burst

Component H represents a high rate of rise pulse whose amplitude and time duration are much less than those of a return stroke. Such pulses have been found to occur randomly throughout a lightning flash, interspersed with the other current components. While not likely to cause physical damage to the aircraft or electronic components, the random and repetitive nature of these pulses may cause interference or upset to certain systems. The recommended waveform comprises repetitive Component H waveforms in 3 sets of 20 pulses each, as shown in the multiple burst waveform in Figure AIII-5. The minimum time between individual Component H pulses within a burst is 50 μ s, the maximum is 1000 μ s. The 3 bursts are distributed according to the following constraints:

The minimum period between subsequent bursts is 30 ms.

The maximum period between subsequent bursts is 300 ms.

(The above replaces the fourth paragraph on page 3 of Appendix III of FAA AC 20-136. Other references to 24 bursts in this AC should also be changed to 3 bursts.)

50 μs ≤ Δt ≤ 1000 μs

One burst is composed of 20 pulses.

30 ms ≤ Δt ≤ 300 ms

20 pulses

REVISED MULTIPLE BURST WAVEFORM